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Evaluation of a collaborative photography workshop using the iPad 2 as an accessible technology for participants who are blind, visually impaired and sighted working collaboratively

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Abstract—A workshop using iPads to train photographers who are blind, visually impaired and sighted is evaluated using grounded theory / methodology and a model of inclusive technical capital. It is hypothesized that all participants find iPad apps accessible. It is found that iPads and apps are generally good introductory tools, but experienced participants who are blind and visually impaired prefer specialized cameras.

Keywords—blind; photography; iPad; disability; inclusion

I. INTRODUCTION

This article presents an evaluation of a photography workshop at Canterbury Christ Church University (CCCU), UK, using the Apple iPad 2 as an inclusive device for blind, visually impaired and sighted participants. Participants of the workshop had varied experiences of taking images previously, and had different forms and levels of physical impairment or none. Participants came from the UK and Germany, whilst three participants were local to Kent.

The motivation for the study was to develop collaborative learning using tablet technologies, along the same lines as previous tuition of mixed sighted and blind groups in multi-modal art education [1], support of blind students in higher education [2], and support of students with disabilities with similar technologies [3], [4].

All participants in the workshop used either their own digital imaging devices or iPads loaned by CCCU. Participants were taught as if they had a severe visual impairment or were totally blind, in order to evaluate inclusive soft skills - soft skills were defined as skills that could be used to develop practical tasks, which feed into further learning or cultural development. The design of the workshop was according to principles of inclusive technical capital, which will be defined below.

The aims of the workshop were to: (a) investigate more cost effective alternatives to expensive, traditional assistive technologies; (b) introduce users to the iPad, a mainstream technology that could, it was hypothesized, support cultural

inclusion; (c) develop education and training on the use of mainstream ubiquitous technologies for alternative purposes; (d) evaluate the development of soft skills using mobile technologies; (e) explore the most effective way of providing training in the use of these devices for photography.

In the following article, we examine the research methodology used to develop, design and implement the workshops, a discussion of findings from the evaluation, and the conclusions that were drawn.

II. METHODOLOGY AND DATA COLLECTION

A. Introduction to grounded methodology

The methodology used in this study was Grounded Methodology (GM) [5], an adapted form of Grounded Theory (GT) [6]. GM is specifically designed without inducing testable theories, but encourages evolution of interpretive deduced theories that evolve through discourse, such as course or workshop design, or the design of a technology. As it is more flexible, GM can also be applied to forms of investigation that are not normally associated with GT, such as literature searches [5].

As with GT, GM has three phases of study: open, axial and selective phases. Data is collected and analyzed in different ways during these three phases. During the open phase, categories of behavior, identity, objects or environments that are to be examined during the study are identified, and theories of analysis begin to be developed. This provides a focus for the research. For example, in previous research using this methodology, learning environments and participants were classified according to individual impairments in order to examine appropriate technologies for learning support [7].

During the axial phase, links between variables in individual categories are linked together or the categories are developed into a testable pedagogy – the latter was the case in this research. If it is for a study of a course or workshop, this linkage is done for practical purposes and provides a direction for evaluation. If this methodology is used for an observational

study, individual variables such as gender or educational level are identified and compared. Between axial and selective phases, a hypothesis is developed that is tested during evaluation or observation. During the selective phase, evidence is gathered to test this hypothesis through data collection, such as workshop or course evaluations, or through observation.

As with GT, GM also constantly compares data, refines its methodology and regards all forms of data as equally important, valuable and useable. This flexible approach to data collection suits reflexive, problem solving approaches to new contexts, topics and settings, which are previously unscrutinized or have been under-investigated in pedagogical design. Data and theoretical approaches can also be stored for later research, where they can be applicable in a different context. This differs from GT, where it is expected that the investigator enters the study from a naïve perspective [6].

There are also practical differences between GT and GM. Most notably, GM is more accommodating to mixed analyses of qualitative and quantitative data, whereas GT is linked largely with qualitative studies. GM also relies less on formal coding, which has evolved to become a significant element of GT. GM, by contrast, relies more on narratives developed by the researcher in order to state an original problem [5]. GM is also applicable to non-traditional research studies, such as the design and evaluation of learning, or a structured literature search.

B. Phases of workshop design and evaluation

In this study, the open phase consisted of developing a model of design and evaluation. In this case, this was shared with a similar study on the use of mobile technologies to develop study skills [3]. This needed little adjustment – despite its position as a different phase of study in previous research – and much of the groundwork was therefore set prior to the study. The axial phase developed a possible model of pedagogy for testing, through analysis of previous experience. This was based on the theoretical model – this model used a social rather than a medical approach, in order to comply with CCCU's policy on support for students with disabilities [8].

The axial phase initially evaluated the assistive / inclusive features of Apple's tablet operating system and apps, in line with the model of development and evaluation from the open phase of study. This evaluation was based on previous experiences of developing photographic courses, and compared different experiences of working with iPads. From this learning model, a hypothesis was developed in order to conduct the evaluation.

To implement GM, the evaluation used two data collection methods: participant observation and a questionnaire for those participating in the workshop [5]. The questionnaire used open questions, which invited protracted answers. The questionnaire was created and returned in MS Word format – this software is largely accessible to blind and visually impaired people, and is used universally. The questions forming the surveys were split into two, with the first set asking participants' personal details, and the second half asking about their experience of the workshops.

The eventual workshop was voluntary, and the participants were self-selecting. Students were also asked to self-identify as blind, visually impaired or sighted – or as other disabilities if it was relevant – if they felt comfortable doing so. The choice of declaring neither was also given, although all participants seemed happy to let us know their status. There also appeared to be no issues with people concealing impairments during the course of the workshop, as no problems identifying the subjects without verbal descriptions were recorded.

The questionnaire and workshop were conducted in accordance with the British Educational Research Association's guidelines on ethical research [9], and its proposal was passed by CCCU Faculty of Education's Ethics Committee. Consent forms were provided for all participants of the workshop, where the opportunity to withdraw from the evaluation was offered. No participants asked to withdraw, and seemed willing to give their opinion – the evaluation was not dependent on attendance of the workshop, and no coercion was applied through incentives.

Eventually, the following participants were recorded attending the workshop: four army veterans who were blind from the group, Blind Veterans; a local person who was blind; a person who was profoundly blind and a sighted companion; one local person who was physically disabled; one sighted local artist; three sighted CCCU staff members on different days. What follows is a report on the phases of research, and the conclusion to the study.

III. OPEN PHASE: DESIGNING A MODEL OF DESIGN AND EVALUATION

A. Bourdieu's models of capital accumulation

The model of evaluation and design was founded on Bourdieu's theory of social and cultural capital [10]. This model was chosen as it fit previous observations on cultural distinctions in the educational use of technologies by people with disabilities [2], [3]. This theory hypothesized that accumulation of capital was not just restricted to material wealth that divided societies. Instead, Bourdieu believed that behavior, ontological perspective and other abstract human attributes could be seen as capitals, as they also provide social distinctions. In particular, possession of these more abstract capitals divided access to education, artistic tastes, accent and language. In turn, this division effected social and cultural status, and an attempt to validate a socially or culturally superior identity.

Bourdieu termed these abstract capitals social and cultural capitals – social capital effecting social status, such as employment and title, and cultural capital effecting cultural status, such as knowledge, education, and intellectual and aesthetic tastes. These capitals thus comprised a complex yet subtle social stratification. For example, according to Bourdieu a person could be poor, but if they were highly educated and had Bohemian or avant-garde tastes in writers or painters, they could be regarded as having high social and cultural status.

There are criticisms of Bourdieu's theory of capitals. For example, Lamont [11] observes that Bourdieu's theory is full

of generalizations. Fowler [12] argues that Bourdieu is culturally subjective, and that his observations as to what constitutes a capital is Franco-centric. Chaney [13] and Alexander [14] also observe that his classification of social classes in particular is too rigid, deterministic, and lacks any consideration of social evolution. In particular, they find that social mobility blurs the lines as to what are working and middle classes. Chaney and Alexander also argue that Bourdieu overlooks the way that working class behaviors now have cache.

Nevertheless, for the purpose of the design of the model of inclusive technical capital, Bourdieu's theory provided a framework that allowed us to examine social and cultural distinctions in a different form of socially defined group. It could, moreover, be applied to the epistemological class of disabled people using its broadest terms of reference. More importantly, Bourdieu provided an explanation that could be used to analyze the transmission of knowledge [15].

In particular, Bourdieu argued that capital was primarily acquired through agencies, such as the family, peer groups and institutions – including schools, universities, clubs or societies [10], [15]. This supported the observations of previous research with students and professionals who were blind [3], [16], [17]. Bourdieu [15] argued that to develop capitals was to acquire habits (*habitus*); i.e. unconscious social behaviors based on beliefs. Thus, capitals were “principles which generate and organize practices.” (p. 53).

B. *Habitus and the development of capitals*

In the context of distinctions in learning, Lizardo and Swartz argue that *habitus* is also internalized tradition, and see it linked strongly to the development of non-verbalized knowledge and inculcation into one's own culture [18], [19]. Psychologically, *habitus* has also been seen as social-cognitive development, relevant to an analysis of inclusion of people with disabilities, as it links to the non-formal learning of education [8].

For example, it has been found that people who are born blind are often excluded from mainstream technologies as they are taught in separate classes. This early experience is found to also later exclude these same people from numerous mainstream computing practices, despite a successful career in computing [16]. In a further example, a study of students' uses of the Internet in art classes at California School for the Blind observes that reduced success at mainstream school due to diminished study support results in a lack of educational success [17]. This subsequently leads to the students' lack of belief in their capacity to engage with art in other situations, such as discussing painting during art classes.

Similarly, lacking similar forms of capital in education can lead to a lack of knowledge of one's own culture, including knowledge of prevailing technologies that can enhance, deepen or further develop learning [10]. For example, knowledge of mainstream technology can allow students to develop the *habitus* of accessing information from on-line academic material. This in turn can allow students with disabilities to

develop further cultural capital, such as knowledge from the contents of a book [3].

Thus, it is hypothesized that the process of developing capital can become recurring practice, which allows students to develop an academically confident, knowledgeable and successful identity. This new identity perpetuates cultural capital through higher and further learning, which reinforces an academic identity until it becomes a habit. Subsequently, mainstream learning, and the use of the field of mainstream technologies - technical capital - becomes habitualized [20], [21]. Bourdieu [10] argues that through a cycle of habituation, the practice of knowing a field of study - such as a subject learnt at school or university, a trade or profession develops cultural and social practice, and distinguishes those with capital from those without. This evolution of practice is expressed in formula (1) [10]:

$$[(habitus)(capital)] + field = practice \text{ (p. 95)}$$

(1)

C. *Technical capital as a form of cultural capital*

Yardi [22] defines technical capital as: “the availability of technical resources in a network, and the mobilization of these resources in ways that can positively impact access to information and upward mobility.” (p. 1) Technical capital is also theorized as a subset of cultural capital, as it is derived largely from education and similar cultural practices [22].

In this study, technical capital is also applicable, as it is hypothesized that the development of this particular form of cultural capital can lead to inclusion in further cultural activities, such as museum visits and other forms of art education. Furthermore, it is hypothesized that technical capital also increases the potential development of further employment and education. Therefore, soft skills can also equate to a part of technical capital in our model of analysis.

For instance, although ubiquitous for many sighted people, we hypothesize that the ability to zoom in on images can enable users with low vision to access information on graphics, which could only be seen usually using large, immobile and expensive screen readers. Therefore, being able to interpret graphics can also give users the potential to access other forms of visual education and training. This reasoning leads us to the following research question: Can knowledge on the use of mainstream devices, such as iPads, lead to cultural inclusion?

IV. AXIAL PHASE: THE DESIGN OF A MODEL OF CULTURAL INCLUSION & TECHNOLOGY

A. *A model of inclusive technical capital*

To address this question, we adapted a previous model of inclusive technical capital in the development and analysis of our workshop – this was thus a subset of both Yardi's model of technical capital [23] and Bourdieu's notion of cultural capital [10], [15]. This model was defined as, practice using inclusive mainstream technologies to promote inclusion in forms of social, cultural and financial capitals, through enabled *habitus* in education and training [3].

The main practice of inclusive technical capital is the substitution of mainstream technologies, such as PCs, smartphones, laptops and tablets, for custom built traditional assistive technologies wherever possible. In the context of inclusive technical capital, assistive technologies are defined according to Kylberg et. al.'s [23] broad definition: "assistive technology (AT) denotes equipment or devices used to support overall health in terms of activity and participation in everyday life for older people and people with disabilities." (p. 51)

Hayhoe [20], [21] gives three reasons why traditional assistive technologies, such as zoom devices, have the potential to exclude people who are disabled: 1) they draw attention to disabled students in educational environments; 2) they separate and exclude people with disabilities from those who are able bodied in mainstream environments; 3) specialized training is needed to use many traditional assistive technologies, such as Brailers or technologies related to mobility. This training is often provided in separate institutional settings.

This led to the re-writing of Bourdieu's [10] formula to define inclusive practice - formula (2) - according to the development of inclusive practice for people with disabilities. In this formula, mainstream technological habitus is technical habits that are developed through the use of technology; inclusive technical capital is the knowledge developed through previous practice or training; and learning field is the topic that the technology is applied to, be it the study of a particular topic or working in a particular role. In addition, a feedback loop is added to illustrate that practice reinforces habitus and capitals:

$$\begin{array}{c} \text{[(technological habitus) (technical capital)] + learning field =} \\ \leftarrow \text{inclusive practice} \\ (2) \end{array}$$

B. Applying inclusive technical capital to mobile technologies

In the application of this model, it was found that access to inclusive technical capital is likely to come from mainstream settings and apps that have been embedded in modern tablet devices [20], [21]. This is largely because these devices: 1) do not separate people with disabilities from non-disabled peers using the same devices; 2) they also do not draw attention to or create differences between disabled and non-disabled people; 3) their settings can be learned alongside sighted peers or through online tutorials.

Therefore, tablets lend themselves to redefinition as inclusive technologies, as previously defined by Hayhoe — i.e. mainstream technologies that can be used by people with disabilities with few or no adaptations [16]. More particularly, iPads can aid written, audio and graphic communications [24], [25], [26].

In previous studies, mobile apps have helped overcome barriers to education through, for example, the audio description of books or re-coloring of text on screen [2]. This inevitably leads to a paradigm shift in understanding what accessible technology is, and a redefinition of systems design as an activity in which disabled users are seen as clients and consumers, and not recipients [20], [21].

It was decided to concentrate on the use of the iPad in this study, as they had been effective in a previous study of supporting students who are blind [4]. In addition, Apple iOS was amongst the first tablet / smartphone operating systems to include inclusive settings as standard, and complies with the US Government's General Services Administration, US Access Board standards and Web Accessibility Initiative [27]. Their compliance has also been supported by articles in the trade press [4]. Apple's approach to its accessible features are broken into the following categories: literacy and learning impairments, visual impairments, hearing impairments, and physical and motor impairments. These are reflected in the iOS settings window, which is partitioned according to these impairments.

Furthermore, in a previous study the iPad was also found to have social advantages, such as: 1) its styling, and the social acceptability of its use in comparison to traditional, highly identifiable assistive technologies; 2) although it is expensive in comparison to other tablets, its cost is relatively low in comparison to traditional assistive technologies; 3) its apparent ease of use out-of-the-box, means that training is kept to a minimum [3], [7].

In relation to visual impairment and blindness, during this study it was felt that Apple iOS provided three particular functions that would support participants in the workshop: 1) voice function to identify objects; 2) a zoom facility for users with low vision, and 3) a function for changing color to photo-negative, which helps users with restricted light perception.

However, as previous evaluations of the iPad in a learning context has shown, some elements need improving [7]. For example: 1) although cheaper than assistive technologies, its cost in comparison to other mainstream tablets is high; 2) the amount of processing time that it takes to use assistive / inclusive settings slows its use in learning environments; 3) it is too early to say whether it significantly improves the prospects of students with disabilities, as no long term evaluations have been conducted.

Despite these issues, studies have found numerous short term advantages of the iPad's native inclusive accessible settings for blind and visually impaired users, such as zoom features, text-to-speech, and its ability to reverse colors [7]. In addition, some standard apps, such as Photo Booth, have color settings that can be changed to include people with certain forms of low vision.

C. Developing instruction for use with the iPad

It was felt that the learning activities should develop a technical understanding of photography — i.e. its mechanical aspects, and what photographs can explore and achieve. This was based on previous models of teaching people who are blind separately [27], [28], [29]. Thus, exercises were designed to include familiar subjects and topics, that would allow all students to relate to the workshop tasks. The exercises were also used to help the participants explore local Kentish environments, exploring issues such as mobility and an understanding of different social, cultural and geographical

surroundings through photography. Thus, the following four days' activities were planned to achieve this aim:

- First day: Introduction to the technology, introduction to different types of photography, uploading and sharing work based on body parts, exhibiting work, and self-portraits. Lecture on the history of photography. These exercises were included, as it was felt that people who are blind, visually impaired and sighted could all share an experience of discovering body parts that they could not normally see, and also get used to the technical aspects of the iPad.
- Second day: A photo-narrative of the life of Canterbury Cathedral and surroundings. This exercise was designed to provide an example of a local heritage environment, which explored the history of the area close to the university. We also did not want to be restricted to areas that were considered to be safe for people with impairments, as this was an inclusive experience.
- Third day: A photo-narrative of the life of Margate beach and sea front based at Turner Contemporary, and an examination of a number of photographs, the gallery and seafront as a backdrop. This exercise was designed to act as a contrast to the previous day's heritage environment, and allowed participants to experience one of the most colorful and vibrant modern environments in Kent on a warm summer's day.
- Fourth day: A summary of the exercises, developing a portfolio for exhibition, and an evaluation of the course. This exercise was designed to allow students to discuss each other's work in more detail, choose each other's favorite photographs from the weekend, and complete their evaluation.

The hypothesis we formed in order to test the development of the workshop was as follows: Students would find the iPads usable and the chosen features accessible during the activities. The collaborative elements of the activities would also allow participants to help each other, develop their technical and social skills, and understand photography from different perspectives.

V. SELECTIVE PHASE: EVALUATING THE WORKSHOP

The analysis of data from the evaluation raised two particular issues affecting our hypothesis: 1) the previous experience of students affected their use and appreciation of the iPads; 2) Different experiences and backgrounds during collaboration made the group work richer, and many social soft skills were developed through cooperative learning whilst using the iPads.

On point 1), our main observation was that the experience of the participants was not related to their visual impairment or blindness. One of the participants who was blind had no experience, but four of the blind participants from Blind Veterans had their own high-end, technically sophisticated cameras – one of these participants was also taking a bachelor's degree in photography, another was working as a

professional photographer, and the other two veterans had significant experience.

Subsequently, the iPad was most popular with those who were blind, visually impaired and sighted with little experience of photography, and who used smart devices for other activities – although the size of this full sized iPad caused some problems for those who were used to smaller devices. *"I use an iPhone, so I was familiar with the technology ... Yes, it was a good opportunity to try working with an iPad. My model was a bit heavy and it would be good to have a protection case, maybe with a strap. Sometimes I was a bit afraid I'd drop it."* {Inexperienced participant who is blind}. *"I found the iPad that I was loaned a marvelous piece of equipment. It is very user friendly ... I had never used an iPad for photography before. I found it understandable and practical to use and fun. And as it was light I found the handling of it manageable as well."* {Inexperienced participant with physical impairment and sight}. By contrast, although all four experienced veterans undertook initial training on using the iPad's accessible features, they preferred to use their own equipment during the activities, or a combination of both iPads and their own equipment. However, they also saw a position for the iPad with less experienced students, both blind and sighted.

For example, Photo Booth allowed one Blind Veteran to see handwriting for the first time since becoming blind decades previously, as it reversed the color of a handwritten page and writing. Furthermore, the professional photographer also taught photography to others who were blind, and after attending the workshop wrote to tell me the following: *"I have encouraged several people to use a tablet for photography as we had a photo week, and a couple of members really struggle with cameras, so they used a tablet all week ... I then did a presentation at a conference on photography where I also showed tablets and I have another member now using a tablet."* {Professional photographer who is blind}.

On point 2), participants found it useful to use the iPad as a collective social tool, discussing their experiences as they went along and comparing images with others – which they did on the iPad's large screen. The participants also stayed in touch after the workshop, and conversations were sent on months afterwards. Participants also found it useful to share techniques and became more socially and technically confident, something that was particularly important to the older participants, who were more vulnerable to social and cultural isolation. One single older participant even brought jars of jam on the final day of the workshop, as a thank you to others.

Observations of the workshop also provided an opportunity to discuss and experience access in numerous ways, providing a potentially different form of soft skill. Most particularly, the participants worked within a physically mixed community, and had to adapt to a different way of learning, working and communicating. This experience was reflected in a number of the quotes from the evaluation: *"[The discussion] gave a useful introduction to technology and the history of photography. It provided me with a theoretical background and helped me to find motives and inspirations for my pictures. I enjoyed talking to other participants and looking at their pictures. Everyone was very nice and the accommodation of people with different*

disabilities worked very well.” {Participant who was blind}. “The teaching was interesting, thought provoking and stimulating. The tour was fabulous. Interesting, visually and orally. A most informative and enjoyable experience.” {Participant with sight}.

VI. CONCLUSION

iPads, particularly when used collaboratively, have the potential to develop soft skills and inclusive technical capital. Participants using these technologies can learn with and from each other, producing images collaboratively, and remaining connected afterwards. This leads to potential social as well as technical confidence, and encourages cultural development. However, what effects these soft skills and this inclusive technical capital will have on future educational development is as yet unknown. Thus, a critical methodology and further studies now need to be developed, in order to assess long term impact and sustainable cultural development.

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